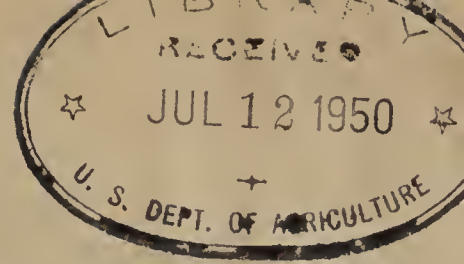


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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
Bureau of Animal Industry
Washington, D. C.



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REPORT ON INFECTIOUS EQUINE ENCEPHALOMYELITIS
IN THE UNITED STATES IN 1942 *

By J. R. Mohler, Chief of Bureau

Much to the benefit of farmers and the food production program, infectious equine encephalomyelitis was less prevalent in 1942 than in any year since 1936. Although the disease occurred in 35 States, only 4,939 cases were reported. Again, however, the infection occurred chiefly in many of the more important agricultural areas. The State of Iowa, for example, alone accounted for almost one fourth of all cases reported for the entire country. More than 84 percent of all the cases occurred in Iowa and eleven other States, namely, California, Idaho, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, Oklahoma, and South Dakota.

A summary of the reports on incidence and mortality from the disease is given by geographic divisions and by States in table 1. Figures given in the column headed, "horses and mules in affected areas," are usually the total number of horses and mules in all affected counties in the State concerned. In most cases these totals are taken from the Sixteenth U. S. Census of Agriculture, 1940. In some instances, however, numbers less than those for entire counties were given by reporters, in consideration of locally significant geographical and epizootiological demarcations within the affected areas.

Figure 1 shows the location of infected counties during the year, which is divided into pre-epizootic, epizootic, and post-epizootic periods. Only about 60 percent of the cases reported were considered in this presentation, owing to lack of complete information on the remainder.

Figure 2 is the usual epizootiological map of the United States, showing the rate of incidence of equine encephalomyelitis by counties.

* Data were taken from monthly and annual reports submitted to the Bureau by State livestock sanitary officials, State experiment stations, State extension veterinarians, and Bureau inspectors in charge, and were obtained in the field by direct contacts and through practicing veterinarians, county agricultural agents, and others. Grateful acknowledgment is made to all cooperating in the project.

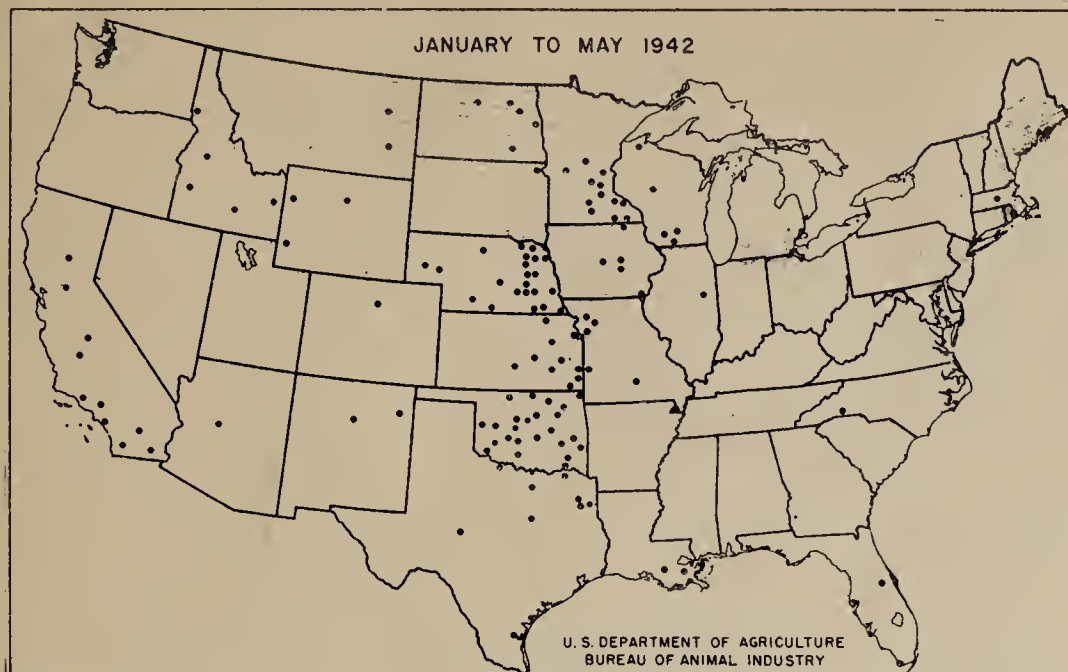
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Table 1. Infectious equine encephalomyelitis--summary of reports on incidence and mortality by States, 1942 (1)

State and division	Horses and mules in affected areas	Animals affected	Cases per 1,000 horses and mules	Total deaths	Deaths per 100 affected animals	Month of report of--	
						First case	Last case
Maine -----	---	0	---	---	---	---	---
New Hampshire -----	---	0	---	---	---	---	---
Vermont -----	15,482	4	0.3	2	50	July	July
Massachusetts -----	6,960	6	0.9	2	33	March	September
Rhode Island -----	---	0	---	---	---	---	---
Connecticut -----	---	0	---	---	---	---	---
New England -----	22,442	10	0.4	4	40	March	September
New York -----	---	0	---	---	---	---	---
New Jersey -----	---	0	---	---	---	---	---
Pennsylvania -----	---	0	---	---	---	---	---
Middle Atlantic -----	---	0	---	---	---	---	---
Ohio -----	---	0	---	---	---	---	---
Indiana -----	232,440	124	0.5	50	40	June	October
Illinois -----	402,185	300	0.7	74	25	June	October
Michigan -----	25,885	102	3.9	93	91	August	October
Wisconsin -----	238,159	74	0.3	14	19	April	October
East North Central ---	898,669	600	0.7	231	39	April	October
Minnesota (2) -----	469,812	319	0.7	49	---	April	October
Iowa -----	734,000	1,217	1.7	262	22	May	November
Missouri (2) -----	395,589	501	1.3	8	---	March	October
North Dakota -----	173,718	70	0.4	21	30	May	October
South Dakota -----	193,149	146	0.8	51	35	June	October
Nebraska -----	442,530	556	1.3	137	25	March	October
Kansas -----	176,725	137	0.8	27	19	May	October
West North Central (2) ---	2,585,523	2,946	1.1	555	23	March	November
Delaware -----	12,314	8	0.6	8	100	July	October
Maryland -----	4,000	5	1.3	5	100	August	September
Virginia -----	9,780	16	1.6	9	56	June	September
West Virginia -----	---	0	---	---	---	---	---
North Carolina -----	30,829	45	1.5	24	53	May	October
South Carolina -----	---	0	---	---	---	---	---
Georgia -----	7,258	5	0.7	5	100	August	October
Florida -----	18,416	59	3.2	51	86	May	September
South Atlantic -----	82,597	138	1.7	102	74	May	October
Kentucky -----	---	0	---	---	---	---	---
Tennessee -----	---	0	---	---	---	---	---
Alabama -----	---	0	---	---	---	---	---
Mississippi -----	17,776	9	0.5	5	56	January	July
East South Central ---	17,776	9	0.5	5	56	January	July
Arkansas -----	28,288	5	0.2	5	100	June	August
Louisiana -----	4,876	20	4.1	18	90	May	August
Oklahoma -----	364,589	377	1.0	114	33	May	December
Texas -----	180,770	48	0.3	17	35	May	November
West South Central ---	578,523	450	0.8	154	34	May	December
Montana -----	46,943	47	1.0	18	38	May	September
Idaho -----	16,897	140	8.3	28	20	April	October
Wyoming -----	83,500	91	1.1	31	34	May	September
Colorado -----	90,414	33	0.4	15	45	May	October
New Mexico -----	16,500	17	1.0	9	53	May	October
Arizona -----	21,845	10	0.5	5	50	May	October
Utah (2) -----	45,400	88	1.9	53	---	June	August
Nevada -----	15,939	44	2.8	13	30	June	September
Mountain (2) -----	337,438	470	1.4	172	31	April	October
Washington -----	54,102	24	0.4	11	46	June	August
Oregon -----	48,595	25	0.5	10	40	June	July
California -----	159,910	267	1.7	90	34	May	November
Pacific -----	262,607	316	1.2	111	35	May	November
Total or average -----	4,785,575	4,939	1.0	1,334	30	January	December

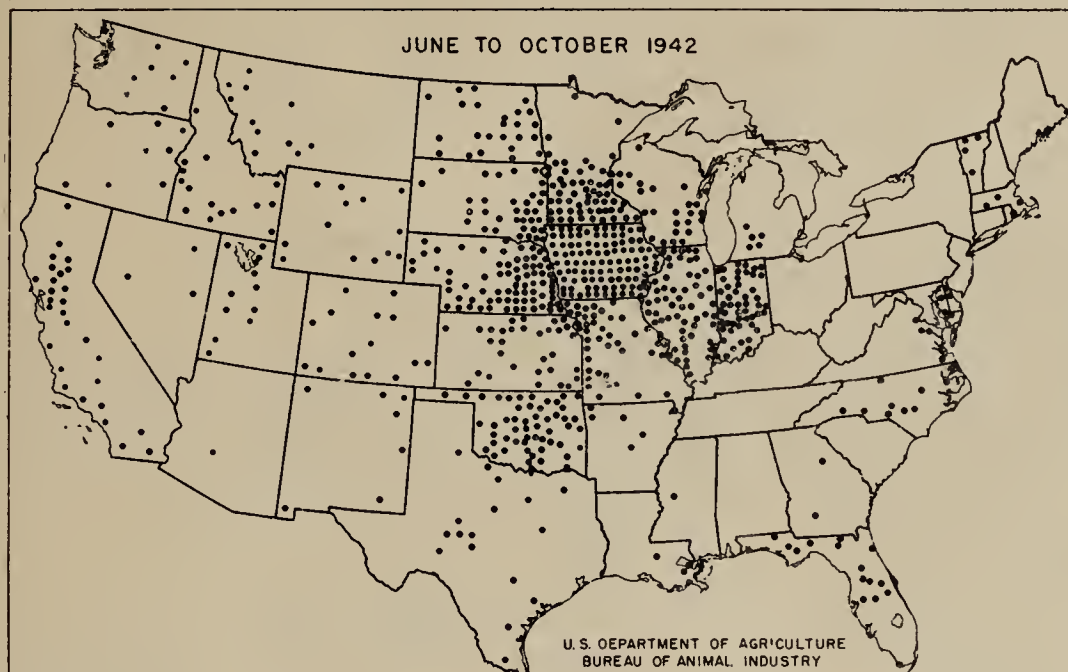
1) Data were compiled on the basis of reports received up to February 1, 1943.

2) In these States, data given were incomplete, and some calculations are excluded.



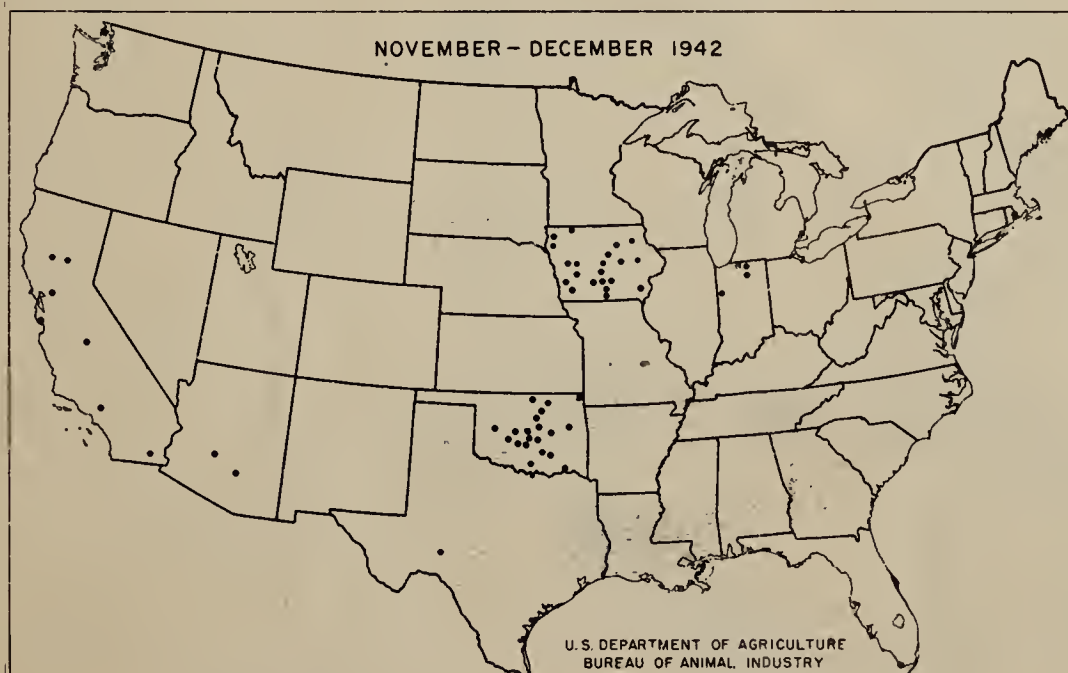
PRE-EPIZOOTIC PERIOD
CASES REPORTED FOR:

JANUARY	-----	1
FEBRUARY	-----	0
MARCH	-----	1
APRIL	-----	10
MAY	-----	148
TOTAL		160



EPIZOOTIC PERIOD
CASES REPORTED FOR:

JUNE	-----	237
JULY	-----	535
AUGUST	-----	687
SEPTEMBER	-----	751
OCTOBER	-----	491
TOTAL		2,701



POST-EPIZOOTIC PERIOD
CASES REPORTED FOR:

NOVEMBER	-----	83
DECEMBER	-----	2
TOTAL		85

Figure 1.--Distribution of reported cases of equine encephalomyelitis according to periods during 1942. Each dot represents a county in which one or more cases occurred during the period.

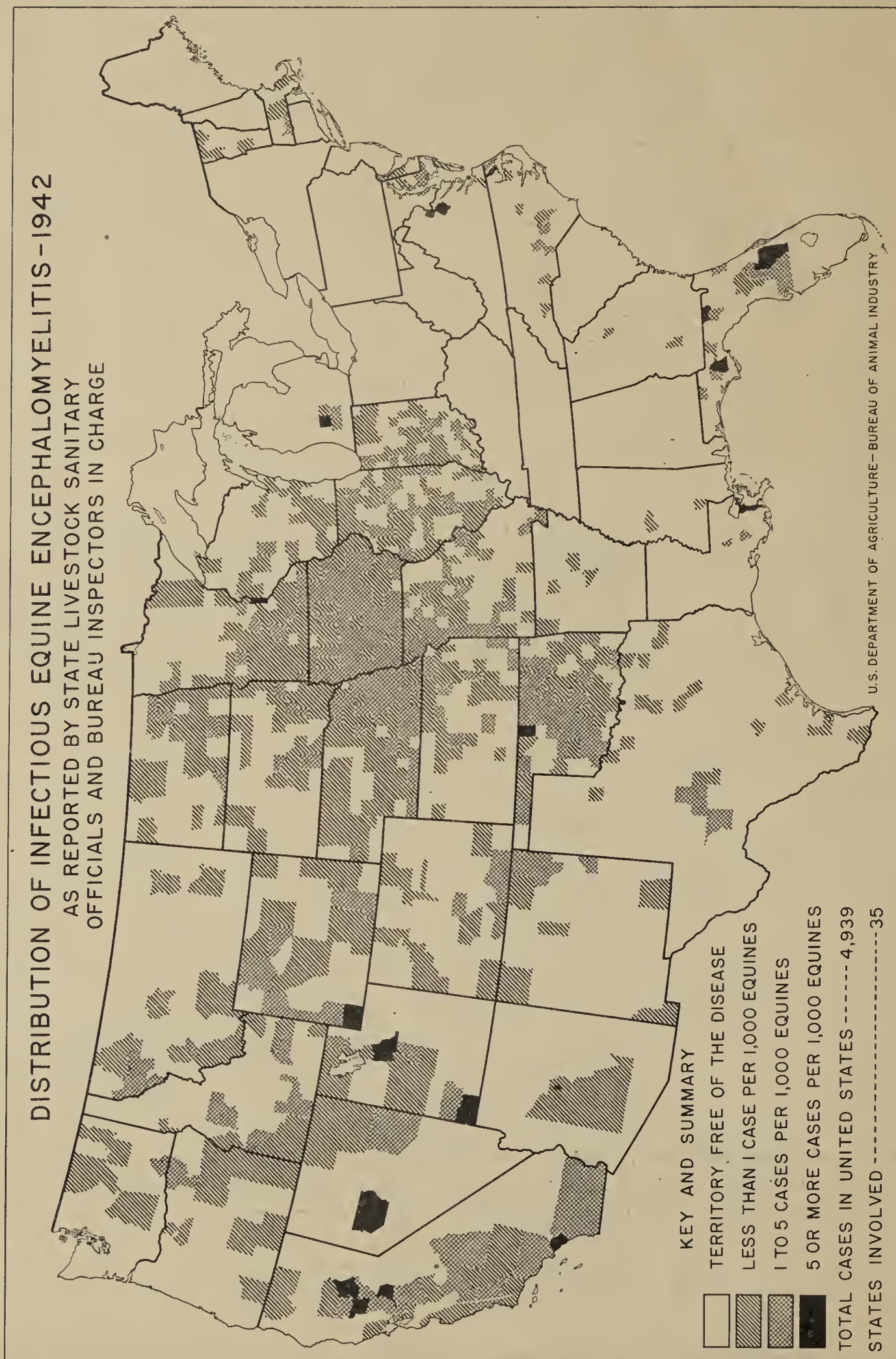


Figure 2.-Distribution and degree of incidence of infectious equine encephalomyelitis, 1942.

Many agencies, including the Bureau, have studied equine encephalomyelitis as a specific virus disease since 1930, when the causative virus was discovered by Meyer and associates in California (9). Considerable attention has been given to determinations of the 2 immunologically distinct strains of virus which have been recognized. Continuing this study in 1942, workers in the Bureau isolated and typed 7 strains of the virus from equine brains (12). Western-type virus again was found in a specimen from North Dakota, and an Arizona specimen yielded western virus for the first time. Eastern-type virus was determined in Florida, Maryland, Michigan, and Virginia specimens. In all instances, except the Michigan specimen, the virus found conformed in type with strains previously demonstrated in these States. With Arizona added to the States where western virus had been found previously, the list now totals 18 States. Eastern virus has now been demonstrated in 13 States, including Michigan, where only western virus had been identified before. Both types of virus have been found in 3 widely separated States, Alabama, Texas, and Michigan. Present information as to the distribution of the 2 types of virus is summarized in table 2.

Table 2. Types of equine encephalomyelitis virus found in the United States, 1930-1942*

States from which western-type virus has been identified	States from which eastern-type virus has been identified	States from which the type of virus has not been identified	States from which the disease has not been reported since 1935
Alabama Arizona California Colorado Idaho Illinois Iowa Kansas Kentucky Michigan Minnesota Montana Nevada North Dakota South Dakota Texas Utah Washington	Alabama Connecticut Delaware Florida Georgia Maryland Massachusetts Michigan New Jersey North Carolina South Carolina Texas Virginia	Arkansas Indiana Louisiana Maine Mississippi Missouri Nebraska New Hampshire New Mexico New York Ohio Oklahoma Oregon Rhode Island Vermont Wisconsin Wyoming	Pennsylvania Tennessee West Virginia

*Viruses were recovered on one or more occasions from equines, and also in some cases from man, except in Connecticut where virus has been found only in pheasants and in Washington where it has been found only in mosquitoes.

The immunologic type or types of virus operating in at least 17 States is as yet unknown, or at least unreported, according to the Bureau's information. All of these States have reported some loss from infectious equine encephalomyelitis since 1935, when acquisition of data on the incidence of the disease was begun, and some have suffered serious losses year after year during this time. In some of the 17 States, virus has been found, but not specifically typed; in others diagnosis rests solely upon clinical and epizootiological grounds. Unless the type or types of virus operating in all areas is frequently determined, such vaccination as is done can be applied only on presumptive grounds, that is, on the basis of past findings in the general region under question. While such a compromise may be considered expedient, it is not scientific, and every effort should be made to make repeated virus determinations every year in all localities. For several reasons, this can best be done by laboratories in the States.

Although equine encephalomyelitis virus has been found capable of infecting many species of animals, both mammals and birds, under experimental conditions, few natural infections have been identified outside of equines and man. The eastern type of infection has been found in pheasants and pigeons (13) (4) (2). Western virus has been found in a prairie chicken, a deer, in so-called assassin bugs, in Culex tarsalis mosquitoes, (3) (7) (6), and more recently in a pig (8). Evidence which suggests infection in ground squirrels has been obtained (5). Veterinarians should continue to be on the alert for animals other than horses clinically affected by the equine encephalomyelitis viruses. Searches should be pressed for inapparently infected animals, including birds and arthropods, which could serve as reservoirs for the virus. Though possibly entailing much tedious work, investigations in these fields should eventually yield knowledge of great and far-reaching significance.

From records of the Division of Virus-Serum Control, it is estimated that at least 2,000,000 cubic centimeters of chick embryo vaccine, a quantity sufficient for complete vaccination of 1,000,000 horses and mules, were used in 1942. Of 251,585 horses and mules reported to have been given 2 successive injections of encephalomyelitis vaccine by veterinarians, 89 were reported to have developed encephalomyelitis 10 days or more after having received the second dose. Of the 89 cases, an undetermined number were vaccinated with a product immunologically different from the prevailing virus. Apparently 3 such cases can be accounted for in Michigan, since the animals were vaccinated with western vaccine, but exposed to eastern virus. Some animals, however, seem not to have developed immunity in spite of vaccination of proper type, just as occurs in some experimental animals. Such cases, especially, merit laboratory study for confirmation of clinical diagnosis.

Again in 1942 laymen injected an undetermined number of animals. Some were given only 1 dose, despite the fact that all available evidence points to the necessity of 2 successive doses for maximum protection. From experiments with man and mouse (1) (10) it has been found that the immunity resulting from repeated doses of vaccine may be restored to the original or even a higher level by the injection of a single dose of vaccine, months or even as long as a year after the primary vaccination. However, the immunity resulting from a single primary dose of vaccine is slight, when compared with that which follows 2 doses, and is of much shorter duration. It has been found that some horses retain a substantial immunity for as long as 13 months after receiving 2 successive doses of vaccine (11). Nevertheless, annual vaccination of exposed horses and mules with 2 successive doses of vaccine is still recommended.

The outbreaks of what is now generally believed to have been infectious, or epizootic, equine encephalomyelitis that occurred prior to 1930, differed from the disease now being encountered in at least 2 respects. First, until the last decade or more there was no apparent tendency for the disease to spread to new regions, and second, the malady did not recur year after year in the same localities. On the other hand, since 1930 many States have been affected more or less every year, and the disease is now apparently enzootic in at least 45 States.

Despite the accumulation of much knowledge concerning virus-induced equine encephalomyelitis, it is still impossible to predict with certainty how extensive the disease will be in coming years. Drought has evidently retarded the disease on several occasions, and this is one possible explanation for the relatively low incidence in the Southwest this year. It may be safely estimated that no less than 6 or 7 million horses and mules, almost half the entire number in the country, have been vaccinated with chick-embryo vaccine since 1938 when the product was first used. Undoubtedly, vaccination has played an important part in reducing the incidence of the disease in the past 4 years, but it is not probable that vaccination alone would ever eradicate the disease, unless it were applied on a much wider scale than heretofore. Even then as long as horse breeding continues, there will be susceptible animals, and presumably the virus will persist in nature until animal reservoirs are eliminated or controlled.

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